

XI. A LIST OF THE DRAGONFLIES
RECORDED FROM THE INDIAN EMPIRE
WITH SPECIAL REFERENCE TO
THE COLLECTION OF THE
INDIAN MUSEUM.

Part IV.—Suborder ANISOPTERA.

THE SUBFAMILY AESCHNINAE.

By F. F. LAIDLAW, M.A.

This dominant subfamily has an almost universal distribution and many of its species range over vast areas.

The Aeschnines are for the most part large insects often of brilliant colouring, and with powerful and long sustained flight.

Probably some of the species are of great economic importance both in the larval and in the adult stages. A single individual in the complete course of its life-history must destroy an enormous number of Diptera.

Some of the species show migratory tendencies, for example *Anax* (*Hemianax*) *ephippiger*, which is one of the commonest of Indian dragonflies.

At present the subfamily is divided into three 'groups' of which the first '*Petalia*-group' is not found anywhere in the Orient, and so needs no notice here.

The second and third groups *Brachytron* and *Aeschna* are further subdivided into 'series' which are noticed below.

This classification though probably the best available on our present knowledge of the subfamily is not altogether satisfactory, as there is a likelihood of series of the *Aeschna* group, the mostly highly organized section of the family, being polyphyletic, and it is possible that some genera of the *Brachytron* group may be recessive rather than primitive.

For a general survey of the subfamily reference should be made to Walker's "Monograph of the North American species of *Aeschna*" (*University of Toronto Studies*, Biological series No. 11, 1912); to Tillyard's paper "Life-Histories and Descriptions of Australian Aeschninae" (*Journ. Linn. Soc., Zool.*, XXXIII, 1916) and lastly to Martin's "Monograph of the Aeschninae" (*Catalogue systématique et descriptif. Collections Zoologiques du Baron Edm. de Selys Longchamps Fasc. XVIII, XIX, XX*, referred to in this paper as "Cat. Coll. Selys Aeschninae.")

Group BRACHYTRON.

Series BOYERIA.

The genera of this series are characterized by the absence of a fork to *Rs*, and by the single row of cells between *Rs* and *Rspl.*, and between *M*₄ and *Mspl.* respectively. These genera are but few in number, and are generally regarded as primitive. The oriental genus *Jagoria* shows some specialization in respect of the large eyes and of the dentigerous plate of the female.

Jagoria martini, n. sp.

1 ♂. Near pool, Tiger hill, 8,300 ft., Darjiling Distr., 26-vi-1918 (S. W. Kemp). 1407-2. The specimen is the type.

Length of hinder-wing 40 mm, of abdomen 40 mm.

Venation. That characteristic of the genus. Nodal indicator $\frac{8-17}{8-9} \mid \frac{16-7}{11-10}$. Triangles of fore-wings of three cells, of hinder-wings four celled. Supra-triangles free. Space between *M*₄ and *Mspl.* of two rows of cells on all wings. Pterostigma dark brown, 2 mm. long, braced. Extreme base of wings saffron tinged, the colour not reaching *Ax*₁.

Head.—Lower lip, and all the anterior surface orange brown. Dorsal surface of frons very dark brown, black against the eyes: enclosing a yellow mark on either side in front of each eye, so that the dark colour forms a T-shaped median mark. Vertex and occiput black, the latter minute, with a tuft of black hairs.

Prothorax.—Dark brown.

Synthorax.—Dorsal surface very dark brown, with a pair of oblong oval bands of a blue green colour, running upwards and inwards almost to the upper end of the mid-dorsal carina, but not reaching it; a pair of small lines of the same colour start from near the upper end of the first pair and run transversely towards, but not so far as the humeral suture; meso- and meta-notum green.

Laterally the synthorax is very dark brown with a large, vivid green bar on the mesoepimerite and a second bar of the same colour nearly covering the whole of the metepimerite.

Undersurfaces orange brown.

Abdomen constricted sharply at the third segment, widened again from the fourth to the sixth, the remaining four being narrow; colouring, black above, the sternites orange brown. Segment 1 has a large, green, lateral mark, similar to those of the sides of the synthorax, but slightly more yellow in tone: 2 has a lateral yellow band. Dorsally segments 2-6 have each a pair of apical green spots, semilunar in shape, and very small on 6. In addition 2-4 have each a pair of small transverse marks of a green colour at about the centre of each. Further, 2 has a minute basal triangle of yellowish green.

The *legs* are black; the coxae, trochanteres and bases of the femora brown.

The dentigerous plate of the tenth segment is almost squarely truncate posteriorly, and carries apically a number of small irregularly placed teeth, about fifteen, on its ventral side.

The anal appendages are small, about 2 mm. long, and are carried in the specimen before me directed vertically upwards. The discovery of a species of this genus in the Himalaya extends its range greatly. Hitherto I can find records for Malaya and Japan only, nowhere within 1,500 miles of Darjiling.

Jagoria martini seems to come nearest to *J. venatrix*, Förster, from Buton in the Celebes group. The female of the latter species is unknown.

SERIES BRACHYTRON.

This series is characterized by the symmetrical forking of Rs and by the presence of but a single row of cells between that sector and *Rspl*, as well as between *M*₄ and *Mspl*. The series contains genera which are probably rather primitive survivals of the main trunk of the subfamily, representing to some extent the ancestral line from which the dominant *Aeschna* group has been evolved.

India has at least three genera of the series, probably more. *Austroaeschna* represented here by a single species is noteworthy on account of its distribution; all the other species (if we exclude *Planaeschna milnei*, MacLach. treated by Martin as an *Austroaeschna*) are Australian.

Periaeschna is also represented by a single species originally described from Tonkin.

Martin puts all the other Indian species in the Selysian genus *Caliaeschna*. He includes in it also an Australian species *C. conspersa*, Tillyard, since removed by Tillyard to a distinct genus *Dendroaeschna*.

Förster had already described a species, *Caliaeschna laidlawi*, from the Malay Peninsula. This species is evidently not a *Caliaeschna* at all but seems to find its proper place rather in *Periaeschna*. I have only two males and a female of *Caliaeschna microstigma* from Persia, and a single female of the *Caliaeschna* section of the series on which to base my observations, but as these insects are of exceptional interest and are all rare I take the opportunity of making a few comments on them. The single female above noted I refer to as *Cephalaeschna*? sp.

In his monograph Martin omits mention of the Selysian genus *Cephalaeschna* of which *Cephalaeschna orbifrons*, Selys, was the type. He also omits mention of Karsch's species *Cephalaeschna sikkima*.

De Selys in defining *Cephalaeschna* states that the apical margin of the dentigerous plate of the female is rounded and subdentate. He was not acquainted with the female of *Caliaeschna* at the time at which he wrote his "Synopsis des Aeschnines."

Karsch in his kritik accepts *Cephalaeschna*, but lays no stress on this particular character, depending on the large development

of the irons in *Cephaloeschna* compared with its relatively small size in *Caliaeschna* as sufficing to separate the two genera.

Martin on the other hand employed rather the Selysian character and finding that the dentigerous plate of *Caliaeschna microstigma* ♀ was rounded and subdenticate, appears to have suppressed *Cephaloeschna* for that reason.

Unfortunately he does not appear to have used this character in all his species of *Caliaeschna*. For example, had he done so, he would surely have removed *C. laidlawi* from the genus, since it is stated by Förster to have a dentigerous plate like that of *Gynacantha*.

Hence we cannot rely in every case on his generic determination. The venation certainly does not, so far as my knowledge goes, support the view that all these species are congeneric. From published accounts I find that the dentigerous plate is rounded and subdenticate or without denticles in the following:—

Caliaeschna microstigma, Schneider.

Caliaeschna acutifrons, Martin.

Cephaloeschna orbifrons, Selys.

It is armed with two stout spines in

Cephaloeschna sikkima, Karsch.

Cephaloeschna ? sp.

The venation is dense in *C. orbifrons* and *C. acutifrons*; 'moderate' in *C. microstigma*; and may be described as 'open' in *Cephaloeschna* ? sp. and perhaps in *C. sikkima* and *C. masoni*, Martin. For *C. lugubris*, Martin, I have no data. I hazard a guess that *Caliaeschna* will ultimately be restricted to *C. microstigma*, Schneider, that *Cephaloeschna* will contain the species *orbifrons* and *acutifrons*; whilst a new genus will be required for *C. sikkima* and for *Cephaloeschna* ? sp. This genus will perhaps include *Caliaeschna masoni*, Martin.

The following is a list of references to papers dealing with Oriental species of the group.

de Selys, "Synopsis des Aeschnines". *Bull. Acad. Belg.* (3), V (1883). The genera *Caliaeschna* and *Cephaloeschna* defined.

Karsch, "Kritik des Systems der Aeschniden." *Ent. Nachr.* XVII, 1891, No. 18, pp. 273-290. Suggests a classification of the Aeschnine genera based mainly on venation.

Karsch, *Ent. Nachr.*, XVII, 1891, No. 20, pp. 6-7. *Cephaloeschna sikkima*, Karsch, described.

Förster, *Ann. Soc. entomol. Belg.* LII, 1908, pp. 213-214. *Caliaeschna laidlawi*, Förster, described.

Martin, *Cat. Coll. Selys, Aeschnines*, XIX, XX, 1909. New species of *Caliaeschna*, *Periaeschna* and *Austroaeschna* described in a monograph of the whole subfamily.

Ris, *Supplementa Entomologica* No. 5, June 1916, pp. 55-56, taf. 2, fig. 5. *Caliaeschna* (?) *acutifrons*, Martin, ♀ described.

Tillyard, *Journ. Linn. Soc., Zool.*, XXXIII, July, 1916. *Caliaeschna conspersa*, Tillyard, removed to a new genus *Dendro-*

aeschna. Species originally described by Tillyard as *Caliaeschna conspersa*, *Proc. Linn. Soc. N.S.W.*, XXXI, pp. 727-729, 1906. Lastly, Ris following MacLachlan refers *Austroaeschna milnei* (Selys), from Japan and Formosa to the genus *Planaeschna*, *Supplementa Entomol.* No. V, 1916, pp. 57-58, taf. 2, fig. 6, text-fig. 39), whilst MacLachlan (*Ann. Mag. Nat. Hist.* (6), XVII, 1895, pp. 409-425) defines the genus *Planaeschna*, and refers to an undescribed genus probably identical with Martin's *Periaeschna*. He comments on the importance of the dentigerous plate of the female as a generic character, incidentally remarking on the distinctness of *Cephalaeschna sikkima*, Karsch, as demonstrated by this character, from the type of the genus, and from *Caliaeschna*, Tillyard, *Journ. Linn. Soc., Zool.*, XXXIII.

[*Caliaeschna microstigma*, Schneider.]

Caliaeschna microstigma, Kirby, *Cat. Odonata*, p. 93.

„ „ Martin, *Cat. Coll. Selys Aeschninae*, pp. 108-109, figs. 100-101.

2 ♂ ♂ 1 ♀. Shiraz, Persia, May '71.

Specimens named and labelled by de Selys.

This species has not been recorded from the Indian Empire and probably does not occur within its boundaries.

As stated above it is the only species included by de Selys in his genus *Caliaeschna*.

The eyes of this species are relatively smaller than in other members of the group seen by me, with more regularly rounded margins. The inter-orbital suture is shorter than in other species, but as this is not a plane line it is difficult to estimate accurately. Perhaps the most satisfactory way of describing it is to say that the interorbital suture of *Caliaeschna microstigma* is shorter than a line taken from its anterior end to the anterior apical point of the frons, whilst in *Cephalaeschna* ? sp. as well as in *Periaeschna* and in *Austroaeschna intersedens* the interorbital suture is definitely longer than such a line. Further, in the three latter genera the anterior margins of the eyes meet the suture almost at a right angle, whilst in *Caliaeschna* the angle is about 115°.

The pterostigma of *Caliaeschna microstigma* is unbraced. The strong antenodal cross-nerves are the first and the fifth, the latter lies at, or a little distal to the level of the arculus. The discoidal triangles are relatively small.

The width of the frons is decidedly less than one-half of the total width of the head.

Lastly, the colouring of this species is 'heliochromatic,' that of the other species of the series 'hylochromatic.'

Austroaeschna intersedens, Martin.

Austroaeschna intersedens, Martin, *Cat. Coll. Selys Aeschninae*, p. 101, pl iv, fig. 14 (see also Tillyard, *loc. cit.*).

1 ♂ 1 ♀. Cherrapunji, Assam, 4,000 ft., 2—8-x-14, S W. Kemp. 8186—87/20.

I have been unable to find any character of sufficient importance by which to separate this species generically from Australian *Austroaeschnas*. The pterostigma has a brace (save in the r. hinder-wing of the female) not shown in Martin's figure. The anal appendages of the male bear a considerable resemblance to those of *Austroaeschna parvistigma*, Selys, and the dentigerous plate of the female is a simple spout-like structure, its apical margin armed with a few small spines. The strong antenodals of the fore-wing are the first and seventh in the male, the first and sixth in the female.

The distal strong antenodal lies, as in Australian species, some two or three cells distal to the arculus.

Cephalaeschna ? sp.

1 ♀. Cherrapunji, Assam. 4066/H2.

Wings relatively short and broad, with open venation. Pterostigma very short, well braced. Nodal indicator $\frac{9-19}{13-15} \mid \frac{19-12}{16-13}$. On

the fore-wing the second and seventh, on the hinder-wing the first and fifth antenodals are strengthened. All four triangles contain four cells, *Rs* forks rather nearer to pterostigma than to nodus. The median, basal and supratrangular spaces are all traversed by cross-nerves.

Head.—Upper-lip, clypeus and frons brownish-yellow; occiput small, black with a fringe of black hairs. Eyes large, yellowish green. The frons is very wide, seen from in front it is semi-circular with a prominent ridge separating the horizontal from the vertical part.

Thorax.—Dorsal surface black, with a pair of pale green antehumeral bands, squarely truncate above, pointed below.

The sides of the thorax are pale green, with a single broad black band on either side.



TEXT-FIG. 1.—*Cephalaeschna* ? sp.

Apex of dentigerous plate of female from below (specimen somewhat crushed).

Abdomen brownish black; segment 2 moderately inflated, 3—7 about equal in size, 8—10 progressively smaller. Segment 1 with small mid-dorsal green spot; 2 with longitudinal mid-dorsal band of green, interrupted at its middle and widening at the apex of the segment. At the level at which the longitudinal band is interrupted there are a pair of transverse marks of the same colour. Segments 3—6 with small median and apical spots of green divided into pairs by the mid-dorsal

carina; 7 with minute median spots only. (The median spots on these segments lie on the structure I call the jugum, *vide infra*, under *Anax gultatus*). Segments 1—2 with lateral band of yel-

low, carried on to the apex of 3 laterally. *Legs* black-brown. Base of femora brown. Wings with saffron tinge at base, extending nearly to the arculus. Length of abdomen 44 mm., of hinder-wing 41 mm., of pterostigma 2 mm. Breadth of hinder-wing 12.5 mm.

The apex of the dentigerous plate of this specimen is produced into two stout processes, which are directed almost directly backwards.

The plate has been somewhat compressed in mounting the specimen, and the text-fig. accordingly shows a slightly distorted view of the apex of the plate.

Periaeschna magdalenae, Martin.

Periaeschna magdalenae, Martin, *Cat. Coll. Selys Aeschninae*, p. 157, fig. 157, pl. vi, fig. 22.

1 ♂ 1 ♀. Tura, Garo Hills, Assam. 7975/H 1.

These specimens agree closely with the type specimens described by Martin from Tonkin. Dr. Ris tells me that he possesses specimens of what is probably a distinct species from S. China. I have already noted that I believe *Caliaeschna laidlawi*, Förster is to be referred to this genus.

Periaeschna confronts us with the problem of the independent development of similar structures. It has the venation of the *Brachytron* series combined with a dentigerous plate scarcely distinguishable from that of *Gynacantha*.

Group AESCHNA.

Three series of genera are referred to this tribe, each series culminating in one of the three dominant genera of the subfamily, *Aeschna*, *Anax*, and *Gynacantha*. The tribe is characterized by the curving of *Rspl* and *Mspl* so that they are concave to *Rs* and *M*₄ respectively, and separated from them by at least three rows of cells. Each series is represented in India, *Aeschna* is mainly a temperate genus and has but few representatives and those rather aberrant. *Anax* perhaps the most successful form of the subfamily is remarkable rather for the wide range and individual abundance than for the number of its species, whilst *Gynacantha*, a very specialized holotropical genus, includes a number of crepuscular or shade-loving insects, which are often caught at lights. In addition certain more primitive genera of the tribe are found in the Oriental Region, but so far as I know none have hitherto been recorded for the Indian Empire. Of these genera, which are mainly Malayan in distribution, *Amphiaeschna* seems to me to be a primitive member of the *Aeschna* series, whilst *Heliaeschna* is similarly related to *Gynacantha*. *Heliaeschna* is also closely related, possibly even ancestral to *Tetracanthagyna*, a genus which contains the most nearly gigantic of living dragonflies.

Series ANAX.

I follow Tillyard (*loc. cit.*) in treating *Hemianax* as a division of subgeneric value only. *Anaciaeschna* approaches *Anax* in sufficient degree I think to make it advisable to refer it to the same series.

Anax guttatus, Burm.

Anax guttatus, Kirby, *Cat. Odonata*, p. 84.

" " " " Martin, *Cat. Coll. Selys Aeschninae*, p. 23, fig. 17.

Anax bacchus ♂ *id.*, *op. cit.*, p. 22.

I have found it difficult to deal in a satisfactory manner with the specimens of *Anax* not included in the species *parthenope* and *immaculifrons*. I have adopted what seems to me the method least open to objection of grouping these specimens, all of which I regard as belonging to *guttatus* in its broadest interpretation, in three series which for the present I do not name but merely label A, P, C. Dr. Annandale has given me (*in litt.*) the following notes on the habits of this species:—

"The species of this family common round the little lakes near Sitong in the Darjiling District in the rains (i.e. *A. guttatus* series C) is different from that common in the same places in the autumn after the rains (i.e. *Aeschna ornithocephala*). Kemp collected the former and noted that it laid its eggs in water, and not in mud at the edge of the lake like the *Aeschna*."

And of specimens of series A, from Barkuda Is.

"— a most active and pugnacious insect. One takes possession of the little pond on the island every morning as soon as the sun is well up, and flies round it all day apparently never resting. Frequently another individual flies out from the jungle and begins the same manœuvres, but the original possessor sees him at once, flies at him at once, and the two fight in the air hitting one another with their wings, and I think sometimes even biting with their mandibles. One captured after a fight of the kind had lost the greater part of a hind-wing. I have often seen one of the combatants hit down almost to the ground, and have found a male apparently drowned in the pond, probably having been knocked into the water by another. Often, whilst two males are fighting in this way a third makes its appearance and a second encounter takes place with the victor in the first.

"The Aeschnid however takes no notice of Libellulids and Agrionids flying over the pond."

I have tried to facilitate the description of the abdominal colour pattern of the specimens, and to make accurate comparison between them by the use of a definite terminology applied to special areas of the tergites of the abdominal segments. The terms used need a short explanation (see text-fig. 2). On segments 2–3 of the abdomen each tergite is furnished with a transverse carina in addition to its terminal transverse carinae. On segments

2 and 3 this accessory carina lies at about the middle of the segment, but on 4—8 becomes progressively more approximated to its anterior end. I propose to call it the 'jugum'; that part of the segment in front of it the prejugal part of the segment, and that behind the post-jugal part. Further, the post-jugal part of segments 4—8 can be subdivided by the presence on each of these segments of the ventral longitudinal carinae, and of the accessory longitudinal carinae into supra-carinal, inter-carinal and infra-carinal areas on either side. The accessory longitudinal carinae do not extend to the prejugal part of the segment. Whether the ventral carinae mark the lateral margin of the tergite or no I am not sure. If they do it would follow that the infra-carinal area is formed on either side by the pleurite. But on the whole I think that this area is a part of the tergite.

Lastly, it may be noted that between segments 1 and 2 dorsally there is a remarkable development of the inter-segmental membrane. This brings it about that there is a considerable gap between the tergites of the two segments; this gap is covered by the uniformly buff-coloured membrane.

In some species of *Anax*, for example in *A. parthenope*, this development of the inter-segmental membrane is much less; but the character probably occurs to some extent in all, and is possibly of generic value.

Series A. (Text-fig. 2.)

The specimens belonging to this series I believe to be fairly typical examples of the true *A. guttatus*, Burm.

I have been able to compare them with examples from Borneo, the Malay Peninsula, and I have also seen specimens from various localities in the British Museum.

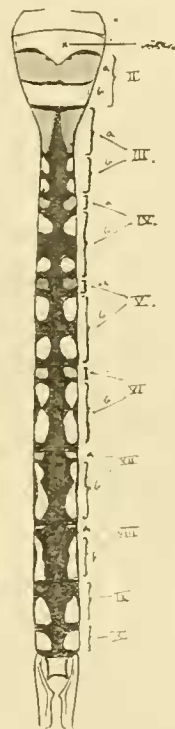
There are differences in details of coloration, size and shape of the anal appendages, but these differences do not exceed the limits of sub-specific variation in my opinion.

The characters of this series may be given briefly as follows:—

♂. (spirit specimens) from Barkuda, 1479/H 2.

Wings.—Membranule with white, basal spot. Wing membrane slightly smoked, with an orange-brown tinge extending from the apex of the triangle to a little beyond the nodus.

Head.—Frons without T-mark, bases of mandibles and genae yellow: upper lip yellow, very narrowly and diffusely edged with



TEXT-FIG. 2.—*Anax guttatus* ♂ Series A.

Abdominal colour pattern (diagrammatic).

a. Prejugal. b. Post-jugal.

brown. Occipital triangle black with yellowish centre and posterior margin.

Thorax greenish-brown, without black markings, save along the suture lines of the coxae; base of femora brown.

Abdomen.—Segment 1, and the inter-segmental membrane between 1 and 2 buff-yellow, posterior margin of 1 narrowly edged with brown. Segment 2 turquoise blue above. The rest of the abdomen is in general brownish-black dorsally, rather paler brown ventrally. Segment 2 has its terminal transverse carinae and jugum black, the blue colour of the dorsum passes laterally to a silvery yellow. Segment 3 has its prejugal division turquoise-blue, passing to silvery yellow ventrally, mid-dorsally a longitudinal black line, widening distally, is continuous with the black of the post-jugal part which carries on either side two large, rounded yellow spots. Segments 4—8 have each a pair of bluish-yellow spots on the prejugal division, almost obsolete on 8, and two rounded yellow spots in the supra-carinal area of the post-jugal division on either side. On 7—8 these supra-carinal spots coalesce to form a continuous yellow band. In addition 4—8 have a round lemon-yellow inter-carinal spot immediately behind the jugum.

Lastly, 9—10 have each a pair of large yellow lateral spots; the homologues of the supra-carinal spots of the preceding segments, on 9 these spots are triangular with the apex directed forward, on 10 they are rounded.

The anal appendages are dark-brown, the upper pair have a blunt triangular projection at the middle of their inner margin.

Length of hinder-wing 50 mm., of abdomen 51 mm., anal appendages 6 mm.

Series B.

The single male of this series is from Calcutta. It is almost exactly intermediate between the males of series A and series C. 6187/20.

In the following account the characters in which it differs from series A are mainly noted; where no remark is made, it may be assumed that the specimen is practically identical with the males of A.

♂ (spirit specimen from Calcutta).

Wings.—The yellow tinge of the hinder-wing less extensive, extending only to the level of the nodus. Basal white mark on membranule very small.

Head.—A small triangular area in front of the vertex is brown.

Abdomen.—The black of the dorsal surfaces is much more intense than in A. The post-jugal spots of segment 3 and the supra-carinal spots of 4—8 are greenish-yellow in colour, rather rectangular in shape, and much smaller than those of A. The supra-carinal spots on 7—8 do not coalesce to form a band and the anterior spot on each of these segments is obsolete. The spot on 9 is small, representing the posterior supra-carinal spot only; and 10 is without markings. There are no inter-carinal spots.

Anal appendages as in A.

♀ not known.

In respect to the colour and colour-pattern of the abdomen this specimen differs strongly from A and approaches C.

In other respects it is not very different from A.

Length of hinder-wing 54 mm., of abdomen 56 mm., of upper anal appendages 6 mm.

Series C. (text-fig. 3).

3 ♂ ♂ 1 ♀. Sitong, Darjiling district, 1405/H 2 (with 2 exuviae); 1 ♂ (spirit specimen).

Wings smoky especially at the apices. Membranule entirely gray black. No yellow tinge on hinder wings.

Head.—Upper lip with well defined, narrow, black margin. Frons with large T-mark. Occipital triangle black.

Thorax with black mid-dorsal carina and sutural lines. Base of anterior femora yellow, the rest black.

Abdomen.—Segment 2 with a longitudinal, mid-dorsal line of black joining the black transverse carinae and the jugum, 3 with the dorsal black band broader in the prejugal division than it is in series A and B. The ground colour of the rest of the abdomen is an intense black, with pale blue spots.

On the post-jugal part of segment 3 both the lateral spots are small, the anterior one minute. On segments 4—8 the anterior supra-carinal spot remains very small, but is larger on 6, 7, 8 than on 4, 5. The prejugal spot is obsolete on 7, 8. Segment 9 has a single small spot homologous with the posterior supra-carinal spot of 8; 10 is black with indistinct lateral brown marks. Segments 4—7 have narrow blue inter-carinal spots close behind the jugum on either side.

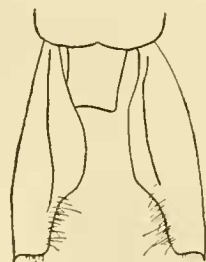
The upper anal appendages are black, and differ in shape from those of series A and B. The middle third of the inner margin of each projects onwards as a straight-edged shelf. The lower appendage is whitish gray with black margins.

The female is in general very much like the male, but the spots of the last six segments of the abdomen are brownish-yellow and not blue, and the tenth segment carries a pair of well defined small spots. The blue colouring of the sides of 2, 3 is largely replaced by greenish brown, and in addition there is a pair of infra-carinal spots immediately below the intercarinal spots on segments 4, 5.

Length of hinder-wing, ♂ 56 mm., ♀ 57 mm.

„ of abdomen, ♂ 55 mm., ♀ 55 mm.

„ of upper anal appendages, ♂ 6.2 mm.



TEXT-FIG. 3.—*Anax guttalis*
♂ Series C.
Anal appendages.

Were it not for the existence of the specimen of series B I should certainly regard those of series C as belonging to a species distinct from A.

Certainly the appearance of well preserved spirit specimens belonging to the two series is strikingly different.

I think we may without doubt regard those of series A as being fairly typical examples of the true *A. guttatus*, Burm. On the other hand series C is evidently identical with the specimens described by Martin (*loc. cit.* p. 22) as *A. bacchus*. These specimens are evidently I think not the true *bacchus* of Hagen which is at best only a slightly differentiated race of *parthenope* (see Calvert, *Proc. Acad. Nat. Sci. Philadelphia*, 1875, pp. 148, 150, fig. 3).

The difficulty is increased by the close resemblance between the upper anal appendages of "form C" and those of *A. julius*, Brauer, which again is a close ally of *A. parthenope*.

But in 'form C' the inferior appendix of the male is very much longer relatively than it is in *A. julius* as figured by Martin (*op. cit.*, fig. 16).

The question as to whether these series should be taken as representing geographical subspecies is one I cannot answer. Series C comes from an elevation of 4000 ft. near Darjiling, and might be regarded as a northern and mountain-dwelling race. I have seen two males of the same form from Japan.

But the Indian Museum collection includes a fine female of series A from 4,900 ft. from Shillong 8252/20, and a second from Nepal valley, 4,500—6,000 ft., 7207/H 1; this latter, apparently mature, is without yellow on the wings.

It seems therefore best to note these series and leave any decision for the future.

Anax parthenope, Selys.

- Anax parthenope*, Kirby, *Cat. Odonata*, p. 85.
 " " Calvert, *Proc. Acad. Nat. Sci. Philadelphia*, 1808,
 pp. 148—149, fig. 3 A—E.
 " " Martin, *Cat. Coll. Selys Aeschn.*, p. 21, fig. 15.

Spirit specimens from Kashmir, 2 ♂ 4212/H 1, 1 ♂ 4317/H 1, 1 ♀ 4008/H 1.

Mounted specimens, 1 ♀ 9775/15 Bangalore, 1 ♂ 6306/20 Bangalore from 3000 ft. (damaged, the abdomen from segments 4—10 has been replaced by that of a ♀ *Anax* sp.), 1 ♂ 9442/14 Seistan, 1 ♀ 5450/20 Srinagar, 1874, 1 ♂ 7200/H 1 Kashmir, 5200 ft.

Specimens mostly in poor condition. All appear to belong to the European race of the species. Its occurrence in Bangalore is comparable to that of *Sympetrum fonscolombi* in the Nilgiri Hills (see Calvert, *loc. cit.*, p. 154).

Anax immaculifrons, Ramb.

- Anax immaculifrons*, Kirby, *Cat. Odonata.*, p. 84.
 " " Martin, *Cat. Coll. Selys Aeschn.*, p. 18, fig. 12.
 " " Martin, *Bull. Soc. entomol. de France*, XII, p. 212
 (1909).
 " " Ris, *Supplementa Entomol.* No. V, 1916, pp. 63—65

1 ♂. Fort, Satara, Bombay Pres. 7930/H 1 (spirit).

1 ♀. Talawadi, N. Kanara Distr. 4383/H 1 (spirit).

1 ♂. Kurseong, E. Himalaya, 6000 ft., 25-x-09, E. A. D'Abreu (pinned).

I possess also a fine pair from Poona, given me by Major Fraser. Dr. Annandale notes that the species is very active, flies high, oviposits on the surface of the water, and rests on rocks.

The spirit specimens, both immature, have a striking appearance; the colour is mainly greenish white with black bands.

Dr. Ris (*loc. cit.*) describes the Indian form as typical and distinguishable from specimens from Hong Kong.

Anax (Hemianax) ephippiger (Burm.).

Hemianax ephippiger, Kirby, *Cat. Odonata*, p. 85.

" " Martin, *Cat. Coll. Selys Aeschninae*, pp. 28—29, fig. 22.

" " Fraser, *Journ. Bombay Nat. Hist. Soc.*, 1919, p. 874.

1 ♂. Agra, Dr. Hankin. 4322/H 1.

1 ♂. At light, Rambhla Rly. Station, Ganjam Distr., Madras Pres. 8217/20.

1 ♀. (fragmentary). At light in railway carriage.

1 ♀. Marikappam, S. India. 6505/20.

Anaciaeschna jaspidea, Burm.

Anaciaeschna jaspidea, Kirby, *Cat. Odonata*, p. 86.

" " Martin, *Cat. Coll. Selys Aeschn.*, pp. 30—31, fig. 25.

1 ♀. Calcutta (N. Annandale). 9270/14.

In very poor condition

The dentigerous plate is almost exactly like that of *Anax*. The median area of the sternite of segment 10 carries a considerable number of minute denticles rather crowded together; it is not specialized in any other way.

I have seen an example of this species from Burma. Its range seems to be chiefly Austro-Malayan.

Kruger notes that he has seen a specimen from Calcutta (*Stettin Entomol. Zeit.* 1898, p. 274).

Series AESCHNA.

Of the Indian species referred to *Aeschna*, two, *A. erythromelas* MacLach. and *A. ornithocephala*, MacLach., are remarkable for the special character of the dentigerous plate of the female which is rather elongate and spout-like, its margin, especially in *A. erythromelas*, beset with teeth more regularly arranged and longer than in other species of the genus. *A. petalura*, known to me only from Martin's description, should probably be removed to a separate genus.

***Aeschna mixta*.**

Aeschna coluberculus, Kirby, *Cat. Odonata*, p. 87.

Aeschna mixta, Martin, *Cat. Coll. Selys Aeschninae*, p. 42, fig. 38.

2 ♀ ♀. Kashmir. 4319/HI.

This is an addition to the known fauna of Kashmir. Mr. Morton has kindly examined one of the specimens for me and tells me that it cannot be separated from European examples of the species.

***Aeschna erythromelas*, MacLachlan.**

(TEXT-FIG. 4.)

Aeschna erythromelas, MacLachlan, *Ann. Mag. Nat. Hist.* (6), XVII, p. 419 (1896).

Aeschna erythromelas, Martin, *Cat. Coll. Selys Aeschninae*, p. 62, fig. 58.

2 ♀ ♀ 1 ♂. Gopaldhara, Darjiling District (per *H. Stevens*).

MacLachlan (*loc. cit.*) has noted the character of the denticerous plate of which I give a figure (text-fig. 4). Perhaps with *A. ornithocephala*, MacL it may require to be placed in a special section of the genus on account of this character. It is a magnificent species of great size and (in the case of the female at any rate) of striking coloration.



FIG. 4.—*Aeschna erythromelas* ♀.
Apex of denticerous plate.

Length of abdomen, ♂ 62+5.5 mm., ♀ 59 mm.

„ of hinder-wing, ♂ 53 mm., ♀ 56.5 mm.

The anal appendages as in the case of the next species are small and pointed in the female.

***Aeschna ornithocephala*, MacLachlan.**

Aeschna ornithocephala, MacLachlan, *Ann. Mag. Nat. Hist.* (6), XVII, p. 368 (1896).

Aeschna ornithocephala, Martin, *Cat. Coll. Selys Aeschninae*, p. 63, fig. 59.

1 ♂. Nam Ting Pokri, Sendim Spur, Sitong 4,000 ft. 3007/HI (teneral).

1 ♂ 1 ♀. same locality, Oct. 22, 1917. 8005 HI.

2 ♀ ♀. same locality and date. 8006/HI.

1 ♀. same locality and date. 7574/HI (teneral).

1 ♀. same locality and date. 7570/HI (adult).

Dr. Annandale has sent me the following interesting note on this species, "A number of females were observed ovipositing (in October, after the rains) in a bank of fairly dry earth at the edge of the lake, one or two feet above the water level. After hovering, with a buzzing sound, a few inches off the bank for some seconds they settled upon it with the head uppermost. The body was raised on the legs, but the tibio-femoral joint was flexed. The abdomen

was turned down in an arch. The median ventral appendage (tereбра) was pulled out from between the lower paired appendages (valves), and rapidly inserted into the earth, in which it left a small hole. In this hole an egg was evidently laid. The tereбра was then rapidly withdrawn, the abdomen turned aside a little and a new hole made at a different spot. Five or six eggs were thus laid in succession at one place. It was difficult to observe details of the process as it was executed with great speed, but the action of the tereбра was easily seen."

The colouring of teneral specimens of both sexes is very similar to that of adult females of *A. erythromelas*. The denticerous plate of the female also resembles that of *A. erythromelas* more than any other *Aeschna* that I know of, but is rather nearer the typical aeschnid plate, having some irregularly placed spines on its ventral surface near the apex.

♂ (Teneral). Anterior surface of head dull brown, vertex and occiput very dark brown almost black.

Thorax dark brown, with broad antehumeral bands, pointed below, truncate above, of pale yellow colour, on either side of the thorax two broad pale yellow bars.

Abdomen brownish red, each segment except the last with a narrow terminal black ring. Segments 1 and 2 with a lateral yellow band, 3 with a small lateral yellow triangle anteriorly.

In the teneral female the colouring is almost identical with that of the male. It differs from that of *A. erythromelas* chiefly in not having the last three segments of the abdomen entirely black.

The more mature female has the summit of the frons black. The abdominal colour deepens to a dull dark brown. A narrow sub-apical ring of greenish yellow appears on each segment from 2-8, and in addition the position of the 'jugum' is marked by a narrow transverse mark of the same colour, interrupted in the mid-dorsal line.

The species is remarkable for the open character of the venation, in which respect it approaches *Aeschna* (?) *petalura*, Martin. The anal appendages however are small and pointed in the female. The wings in the adult female have a yellow tinge which is most marked distal to the nodus and on the anal margin.

Length of abdomen in adult ♀, 52 mm., of hinder-wing 57.5 mm.

Aeschna (?) *petalura*, Martin.

Aeschna petalura, Martin, *Cat. Coll. Selvs Aeschn.*, pp. 78-79, figs. 24-77.

As above remarked this species is scarcely a true *Aeschna*.

The shortness of the triangle of the hinder-wing and the narrow intervals above the radial and median supplements mark it off from the more typical species of the genus. Found near Darjiling and in the Khasi Hills.

Series GYNACANTHA.

This series contains a large number of highly organized tropical insects in both hemispheres which are crepuscular or at any rate shade-loving.

The dentigerous plate of the female is remarkably specialized and bears a remarkable similarity to that of *Periaeschna*.

Gynacantha hyalinia, Selys.

Acanthagyna hyalinia, Kirby, *Cat. Odonata*, p. 95.

Gynacantha hyalinia, Kruger, *Stettin Entomol. Zeit.* 1898, p. 275 seq.

" " Martin, *Cat. Coll. Selys Aeschninae*, pp. 198—199, fig. 203.

1 ♂ 5455/20. loc.?, 1 ♀ 5454/20 Darrang, 1 ♂ 5313/4, 1 ♀ 8306/4 Sibsagar. These specimens all in bad condition bear labels in de Selys' handwriting.

1 ♂ 1478/H 2. Chilka Lake (N. A.), Zool. Surv.

1 ♀ 8287/20. Calcutta, 'flying at dusk.'

1 ♀ 7939/H 1. Calcutta, 'flew to light in Museum,' 14-viii-17 (N. A.).

1 ♀ 8189/20. Cherrapunji.

Gynacantha basiguttata, Selys.

Acanthagyna basiguttata, Kirby, *Cat. Odonata*, p. 95.

Gynacantha basiguttata, Kruger, *Stettin Entomol. Zeit.* 1898, pp. 283—

284, fig. p. 279.

" " Martin, *Cat. Coll. Selys Aeschninae*, pp. 192—193.

" " Ris, *Ann. Soc. Entomol. Belg.* LV, pp. 246—247, fig. 13 (1911).

1 ♀ (in fragments) 5456/20. "Sibs." (Sibsagar, N. E. Assam) (labelled by de Selys).

I have examined 3 males of this species from Lower Siam. It ranges from the Philippine Islands to Burma and Assam. Martin's figure is not that of the appendages of this species (see Ris, *loc. cit.*).

Gynacantha khasiaca, MacLachlan.

Gynacantha khasiaca, MacLachlan, *Ann. Mag. Nat. Hist.* (6), XVII, p. 411 (1896).

" " Laidlaw, *Rec. Ind. Mus.* VIII, p. 340 (1914).

" " Martin, *Cat. Coll. Selys Aeschninae*, pp. 202—203, fig. 207.

1 ♂. Mangaldai, Assam. 6417/20.

Gynacantha saltatrix, Martin.

Gynacantha saltatrix, Martin, *Cat. Coll. Selys Aeschninae*, pp. 194—195, fig. 199.

1 ♂. Mazbat, Mangaldai District, Assam, 11—19-x-10 (S. H. Kemp), 6419/20.

This is the smallest of the Indian species that I know of. Length of abdomen $42 + 6$ mm., of hinder-wing 39 mm.

In addition *Gynacantha subinterrupta*, Ramb. and *Gynacantha furcata*, Ramb. have been recorded from Ceylon by Kirby, together with *Anax (Hemianax) ephippiger* and *Anax guttatus* (Kirby, *Journ. Linn. Soc., Zool.*, XXIV, p. 558).

***Gynacantha millardi*, Fraser.**

Gynacantha millardi, Fraser, *Journ. Bombay Nat. Hist. Soc.*, XXVII, p. 147.

1 ♂ teneral. Chota Nagpur.

This interesting new species differs from other Indian *Gynacanthas* in having but little constriction of the abdomen at the second and third segments, a feature which makes it easily distinguishable from its allies.

There is also a ♀ specimen from Mangaldai, N.E. Assam, which I am not able to determine, it does not seem to be *G. khasiaca*, MacLach.